



Identification key and pictures of the *Hypostomus* Lacépède, 1803 (Siluriformes, Loricariidae) from the rio Ivaí, upper rio Paraná basin

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Abstract

The rio Ivaí flows through the left margin of the upper rio Paraná basin with 798 km of extension, being one of its largest tributaries. In this study, we analyzed 586 specimens of *Hypostomus* Lacépède, 1803 from the rio Ivaí basin deposited in the Coleção de Peixes do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura da Universidade Estadual de Maringá (NUP) and Coleção Ictiológica do Grupo de Pesquisas em Limnologia e Recursos Pesqueiros (CIG). Herein, 14 species of *Hypostomus* were recorded from the rio Ivaí basin (10 already described and 4 possible new). The most representative species was *H. ancistroides*, corresponding to 23.5% of all the specimens, followed by *Hypostomus* sp. 3, with 15.2%, and *Hypostomus* sp. 2, with 13.8%. Considering *Hypostomus*, this study suggests that the rio Ivaí has high species richness compared with adjacent basins, such as rio Parapanema, rio Tibagi, rio Piquiri and rio Iguaçu. Knowing the difficulties founded by many ichthyologists and researchers in identifying species within this genus, we also present here an identification key for its species present in the rio Ivaí basin.

Key words

Armored catfishes; hypostominae; teleostei; Neotropical fishes; taxonomy; check list; diversity; ichthyofauna.

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Introduction

The rio Ivaí is the largest river that runs entirely through the Paraná state, in southeastern Brazil, and it is one of the tributaries that contributes most to the rio Paraná basin (Parolin et al. 2010). With 798 km of extension, the rio Ivaí is formed by the confluence of the rio Patos with rio São João in the municipality of Prudentópolis, southeastern Paraná state, and reaches the rio Paraná in the municipality of Icaraíma, northwestern Paraná state (Maack 2012). Through its extension, the rio Ivaí ranges from 1316 m to 216 m in elevation, and it is considered

an upland river filled with rapids and waterfalls (Parolin et al. 2010).

Hypostomus Lacépède, 1803 (Siluriformes, Loricariidae) has about 135 valid species (Eschmeyer and Fong 2017) in Central to South America (Zawadzki et al. 2016a). The taxonomy of most species of the genus is usually difficult due to old type materials, poor morphological descriptions and the great morphological variation found in local populations, especially regarding the widely distributed species. Moreover, another obstacle encountered by researchers to correctly identify species of *Hypostomus* is the presence of several cryptic species

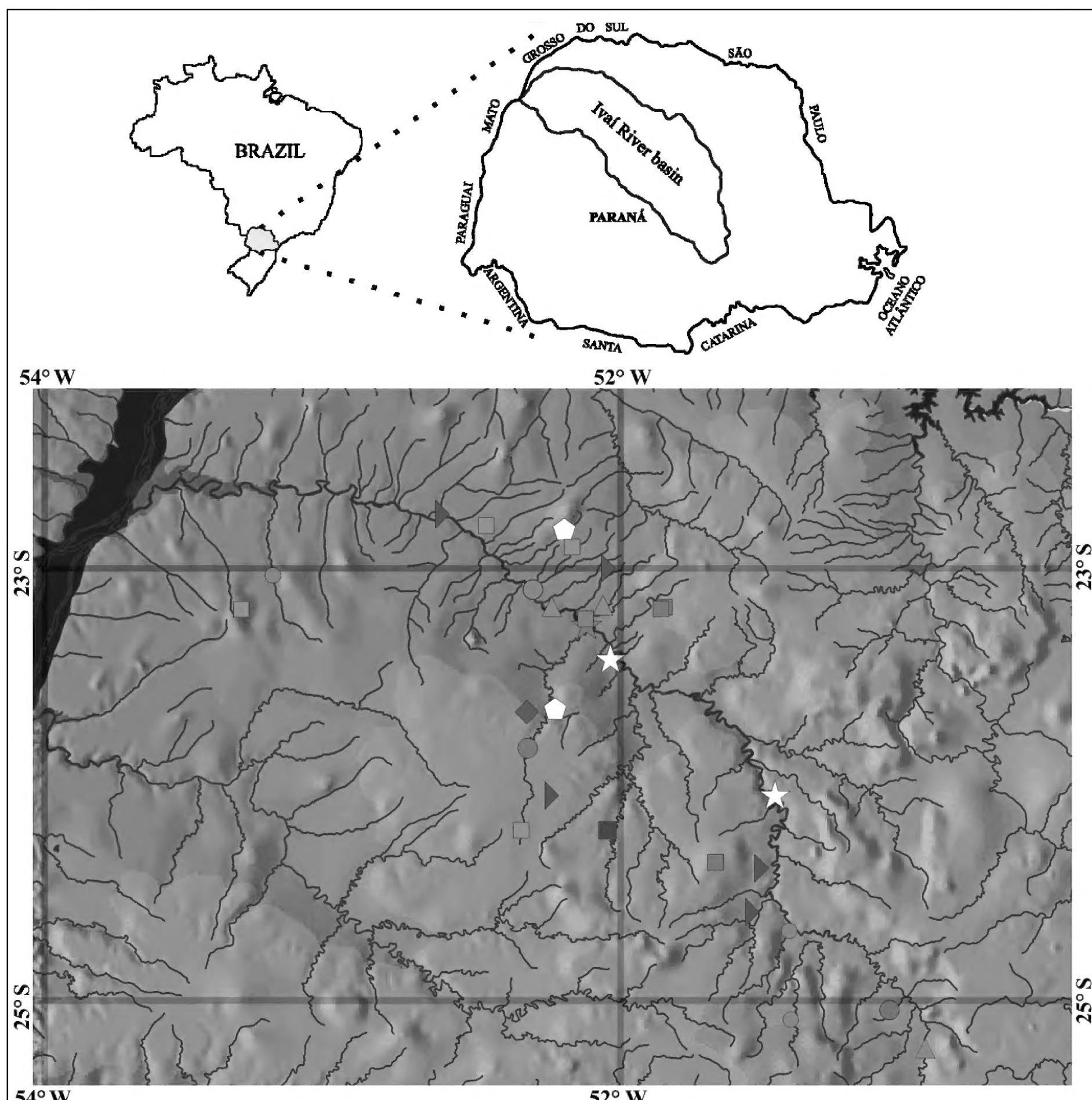


Figure 1. Distribution of the *Hypostomus* species from the rio Ivaí basin and tributaries, Paraná state, Brazil. White pentagon: *Hypostomus albopunctatus*; green triangle: *Hypostomus ancistroides*; yellow circle: *Hypostomus commersoni*; blue circle: *Hypostomus hermanni*; square purple: *Hypostomus iheringii*; white star: *Hypostomus margaritifer*; green diamond: *Hypostomus aff. paulinus*; yellow star: *Hypostomus regani*; blue square: *Hypostomus strigaticeps*; pink square: *Hypostomus topavae*; yellow square: *Hypostomus* sp. 1; green circle: *Hypostomus* sp. 2; pink triangle: *Hypostomus* sp. 3; red circle: *Hypostomus* sp. 4. The datum used for geographic coordinates was WGS84. Some points may represent more than one lot.

with large intraspecific variation in morphology and body pigmentation patterns (Reis et al. 1990). These problems are intensified by the lack of detailed knowledge of the distribution of many species (e.g. *H. strigaticeps* (Regan, 1908)). Consequently, a large amount of the species of this genus found in fish collections and museums is misidentified or identified only to generic level. Most of valid species of *Hypostomus* are distributed in Amazon and La Plata systems (85%) (Zawadzki et al. 2016b). From the 25 species documented for the upper rio Paraná basin (Jerep et al. 2007, Langeani et al. 2007, Zawadzki et al. 2008), 10 species are found in the rio Ivaí basin, along with at least 4 probably new to science.

To help solving these problems and to clarify the differences among the *Hypostomus* species, this work provides a photographic identification key to catalog the ichthyofauna diversity of *Hypostomus* from the rio Ivaí basin, one of the biggest tributaries from rio Paraná, and the most representative in species richness of *Hypostomus* among the rio Paraná tributaries in the Paraná state.

Methods

Study area. The rio Ivaí is a direct tributary of the rio Paraná and constitutes 97.5% of the drainage area of Paraná state (Parolin et al. 2010). In its 798 km length,

the rio Ivaí basin (Fig. 1) runs through many municipalities from the confluence of the rio Patos and rio São João, until the upper rio Paraná, between municipalities of Querência do Norte and Icaraíma (Maack 2012). The rio Ivaí is classified as a typical plateau river and can be divided into upper, middle and lower courses, according to the gradient unevenness of the river, that ranges from 1316 m above sea level (a.s.l.) at the upper course to 216 m a.s.l. at the lower course. The upper course region, located in the municipality of Prudentópolis, is the longest part of the river with about 440 km. It harbors several prominent waterfalls, some above 100 m high, such as the Salto São Francisco (196 m) and the Salto Sebastião (130 m) (Parolin et al. 2010). The rio Ivaí receives numerous tributaries during its course, especially the rio Patos, which is classified by the Ministério do Meio Ambiente and Secretaria de Biodiversidade e Florestas as an area important for biodiversity conservation due its rich ichthyofauna. Nevertheless, the rio Ivaí has much agricultural activity throughout its entire course (Maack 2012).

The middle course of the rio Ivaí, which extends for about 170 km, has a medium gradient and mineral rich soil that allows high productivity of grains, such as soybean, corn, and wheat. Here, there poor attention to environmental preservation, with only small remnants of forest in the municipalities of Cianorte and Tuneiras do Oeste (Parolin et al. 2010).

The lower course of the rio Ivaí basin is about 164 km long and is characterized by sandy soils with low fertility (Parolin et al. 2010). This region has advanced cultivation of sugar cane and rice. The lower course also have large grazing areas for cattle. In this region, there are very few forest remnants (e.g. Parque Estadual do Lago Azul, municipality of Campo Mourão; Parque Estadual de Vila Rica do Espírito Santo, municipality of Fenix) (Destefani 2005, Parolin et al. 2010).

Data collection. The morphometric analysis was based on inspections of previously fixed specimens in formaldehyde and preserved in 70% alcohol, deposited in the Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura da Universidade Estadual de Maringá (NUP), municipality of Maringá, Paraná state, Brasil; and in the Coleção Ictiológica do Grupo de Pesquisas em Limnologia e Recursos Pesqueiros (CIG), municipality of Toledo, Paraná state.

All measurements and counts were taken from the left side of the body (when possible). A digital caliper accurate to 0.1 mm was used to collect the morphometric and meristic data, point to point, according to Boeseman (1968) and Weber (1985). The specimens were studied under a stereoscopic microscope when necessary. Schaefer (1987) was followed for the classification of bony plates, with modifications from Zawadzki et al. (2010).

The list of materials examined present information in the following order: acronym of the collection, number of tipping, number of specimens in the lot, amplitude (mm) of the standard length (SL), river where the species occur, and geographical coordinates.

Results

Fourteen species and totaling 586 specimens of *Hypostomus* (Table 1) were collected and identified in the rio Ivaí basin (Fig. 1). The highest richness of species is represented in Figure 2. The most representative was *H. ancistroides* Ihering, 1911, corresponding to 23.5% of all the specimens, followed by *Hypostomus* sp. 3, with 15.2%, and *Hposyomus* sp. 2, with 13.8%. The less representative was *H. margaritifer* Ihering, 1911, (0.3%), *H. iheringii* (Regan, 1908) (0.5%) and *H. strigaticeps* (Regan, 1908) (1.4%). *Hypostomus* sp. 1, 2, 3, and 4 are possible new species, and they are currently being analyzed for description (Dias and Zawadzki in prep.).

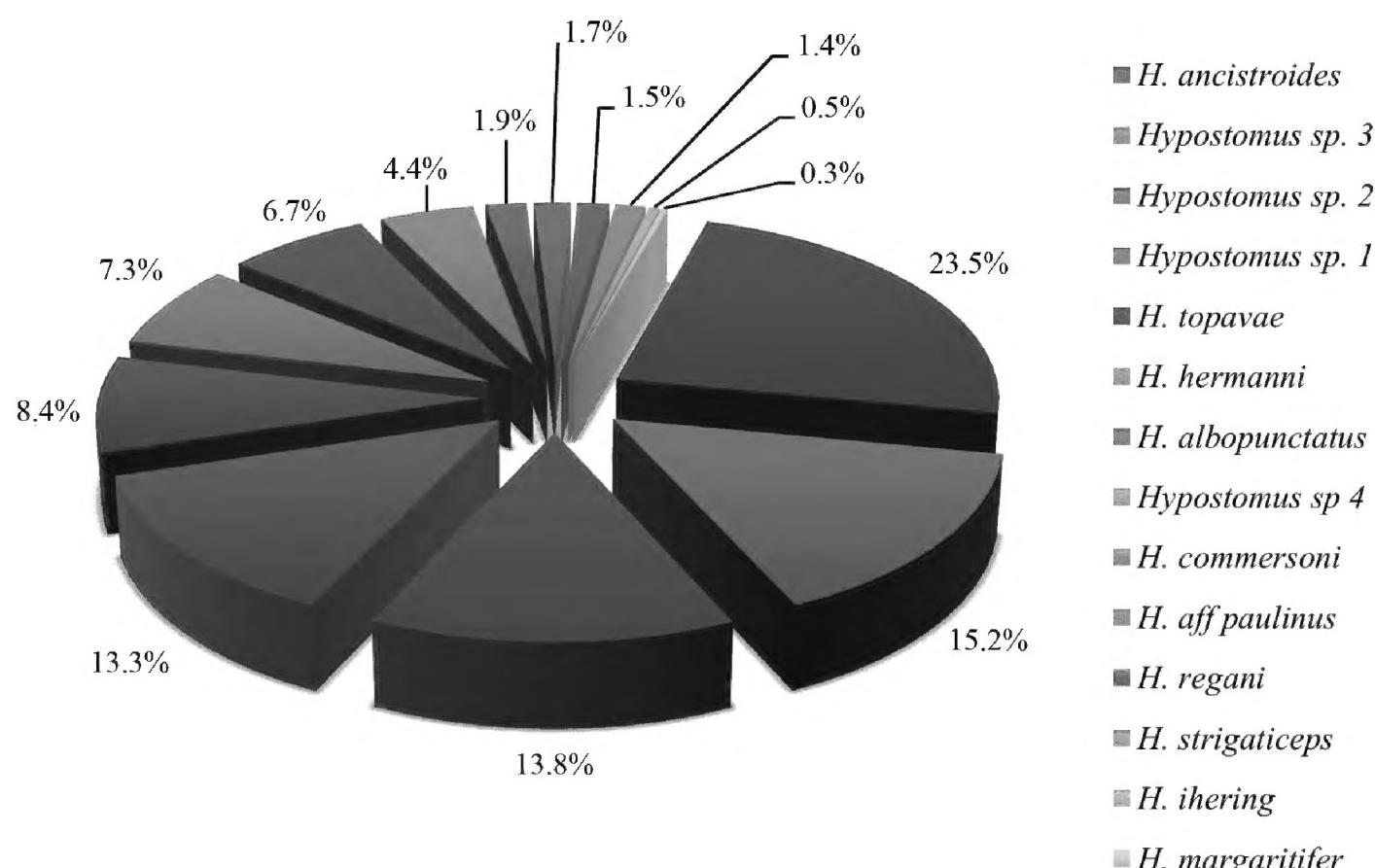


Figure 2. Species richness of *Hypostomus* from rio Ivaí, upper rio Paraná basin, Paraná state.

Table 1. Taxonomic framework of *Hypostomus* and type locality over rio Ivaí basin, upper rio Paraná, according to Weber (2003).

Species	Distribution	Type locality
1 <i>Hypostomus albopunctatus</i> (Regan, 1908)	Upper rio Paraná	Rio Piracicaba, São Paulo state
2 <i>Hypostomus ancistroides</i> (von Ihering, 1911)	Rio Tietê basin	Rio Tatuí, São Paulo state
3 <i>Hypostomus commersoni</i> Valenciennes, 1836	Medium and lower rio Paraná and rio Uruguay basins	Unspecified; there are records of the La Plata basin, rio Paraná, Montevideo and Uruguay
4 <i>Hypostomus hermanni</i> (von Ihering, 1905)	Rio Tietê basin	Rio Piracicaba, São Paulo state
5 <i>Hypostomus cf. iheringii</i> (Regan, 1908)	Rio Tietê basin	Rio Piracicaba, São Paulo state
6 <i>Hypostomus margaritifer</i> (Regan, 1908)	Upper and medium rio Paraná basins	Rio Piracicaba, São Paulo state
7 <i>Hypostomus aff. paulinus</i> (von Ihering, 1905)	Rio Tietê basin	Rio Piracicaba, São Paulo state
8 <i>Hypostomus regani</i> (von Ihering, 1905)	Basins of rio Paraná, rio Paraguay and rio Uruguay	Rio Piracicaba, São Paulo state
9 <i>Hypostomus strigaticeps</i> (Regan, 1908)	Rio Tietê basin	Rio Piracicaba, São Paulo state
10 <i>Hypostomus topavae</i> (Godoy, 1969)	Rio Grande basin	Rio Mogi Guaçu, São Paulo state
11 <i>Hypostomus</i> sp. 1	Rio Ivaí basin	—
12 <i>Hypostomus</i> sp. 2	Rio Ivaí basin	—
13 <i>Hypostomus</i> sp. 3	Rio Ivaí basin	—
14 <i>Hypostomus</i> sp. 4	Rio Ivaí basin	—

We present here a taxonomic framework of *Hypostomus* from the rio Ivaí basin (Table 1), and an identification key for its species.

Identification key

- 1 Body without spots, dorsal and caudal fins with inconspicuous spots *Hypostomus* sp. 1, Fig. 13
- 1' Body with spots, dorsal and caudal fins with conspicuous spots or vermiculated 2
- 2 Body with vermiculated blotches *Hypostomus* sp. 3, Fig. 15
- 2' Body with roundish spots 3
- 3 Body with light spots 4
- 3' Body with dark spots 9
- 4 Pectoral-fin spine equal to or smaller than pelvic-fin spine length *H. albopunctatus*, Fig. 3
- 4' Pectoral-fin spine longer than pelvic-fin spine length 5
- 5 Premaxilla with 15–21 teeth; 13–23 teeth in dentary *H. margaritifer*, Fig. 8
- 5' Premaxilla with >21 teeth; more than 23 teeth in dentary 6
- 6 Caudal fin truncated *Hypostomus* aff. *paulinus*, Fig. 9
- 6' Caudal fin notched 7
- 7 Dentary with 49–57 teeth ... *H. strigaticeps*, Fig. 11
- 7' Dentary with >60 teeth 8
- 8 Premaxilla with 92–99 teeth; 93–106 teeth in dentary; dentary width 19.1–21.3% of head length *H. regani*, Fig. 10
- 8' Premaxilla with 65–89 teeth; 63–91 teeth in dentary; dentary width 21.5–28.1% of head length *Hypostomus* sp. 2, Fig. 14
- 9 Body with keel in lateral series of plates 10
- 9' Body without keel in lateral series of plates 12
- 10 Length of dorsal-fin spine 37.9–42.5% of standard length; length of base of dorsal fin 27.1–27.8% of

- standard length *H. commersoni*, Fig. 5
- 10' Length of dorsal fin less than 37% in standard length; length of base of dorsal fin <27% in standard length 11
- 11 Body spots of similar size to the pupil diameter; superior orbital margin not raised; orbital diameter 12–17.9% of head length *H. ancistroides*, Fig. 4
- 11' Body spots larger than the pupil diameter; raised superior orbital margin; orbital diameter 20.0–21.5% of head length *H. iheringii*, Fig. 7
- 12 Small eyes, orbital diameter 13.5–21.8% in head length; spots on head and body with same size *Hypostomus* sp. 4, Fig. 16
- 12' Big eyes, orbital diameter bigger than 21% of head length; head spots smaller than body spots 13
- 13 Abdomen covered by bony plates; cleithral width 30.7–34.0% of standard length *H. hermanni*, Fig. 6
- 13' Naked abdomen or with few central plates; cleithral width 29.1–30.9% of standard length *H. topavae*, Fig. 12

Brief descriptions of the putative new species

Hypostomus sp. 1, Figure 13

Hypostomus hermanni—Zawadzki 2004: 251. Non Ihering 1905: 560.

Material examined. Table 1; Figure 13; Appendix.

Presence of 25–37 teeth in premaxillary; 23–36 teeth in dentary; orbit diameter 17–24% of head length; lack keels on body; most specimens with abdomen completely naked; pterotic-supracleithrum and supraoccipital without keels. *Hypostomus* sp. 1 has an uncommon pattern of pigmentation, distinguishing it from all other congeners. It can be differentiated from all congeners by its reddish brown body without spots on the dorsal and caudal fins.

Hypostomus sp. 2, Figure 14

Hypostomus sp.—Maier et al. 2008: 338.

Material examined. Table 1; Figure 14; Appendix.

Presence of 65–89 teeth in premaxillary; 63–91 teeth in dentary; orbit diameter 15–24% of head length; mouth length 52–65% of head length; abdomen largely naked; keels poorly developed on dorsal series of plates; pterotic-supracleitrum and supraoccipital without keels. White spots on brown body, smaller than the pupil on head, similar to the pupil on trunk and fins.

Hypostomus sp. 3, Figure 15

Material examined. Table 1; Figure 15; Appendix.

Presence of 62–109 teeth on premaxillary; 65–104 teeth on dentary; orbit diameter 18–22.5% of head length; mouth length 54–71% of head length; abdomen largely naked; keels moderately developed on all series of plates; pterotic-supracleitrum and supraoccipital without keels. Pattern of pigmentation easily distinguished from all congeners; light body without spots, but dark vermiculation in head, trunk and fins.

Hypostomus sp. 4, Figure 16

Material examined. Table 1; Figure 16; Appendix.

Presence of 41–103 teeth on premaxillary; 37–99 teeth on dentary; orbit diameter 13.5–22% of head length; abdomen all covered by plates; lacking keels on body; pterotic-supracleitrum and supraoccipital also without keels. Brown body with dark spots, smaller than pupil on head and trunk, similar to orbit diameter on fins.

Discussion

The rio Ivaí basin recently has become the subject of scientific studies related to fish populations, due to increasing efforts in the sampling of its ichthyofauna (Luiz et al. 2003, Zawadzki et al. 2004, Luiz et al. 2005, Portela-Castro et al. 2007, Graça and Pavanelli 2008, Maier et al. 2008, Araújo et al. 2011, Delariva and Silva 2013, Paiva et al. 2013, Viana et al. 2013, Roxo et al. 2014, Tencatt et al. 2014, Frota et al. 2016, Zawadzki et al. 2016a, b). The recognition of areas of endemism is essential for species preservation (Löwenberg-Neto and Carvalho 2004). As previously mentioned in the literature (e.g. Langeani et al. 2007, Frota et al. 2016), the rio Ivaí contains species not yet scientifically described, as well as possibly endemic species, such as *Characidium heimostigmata* da Graça & Pavanelli, 2008 and *Corydoras lacrimostigmata* Tencatt, Britto & Pavanelli, 2014, and the possible new species *Hypostomus* sp. 1, 2, and 3 are some of the most representative species of this study (Fig. 2), which are probably endemic to the river basin.

Of the 25 species that can be found in the upper rio Paraná system, we recognized 14 species of *Hypostomus* in the rio Ivaí basin, including 10 that are already described and at least 4 that are probably new to science and endemic to this system. Our results corroborates a previous study (Frota et al. 2016), which suggested that the rio Ivaí has the highest species richness compared to adjacent basins. In the rio Paranaapanema basin, 6 species

of *Hypostomus* were recorded (Hoffmann et al. 2005), 5 in the rio Tibagi (Shibatta et al. 2002) and rio Piquiri basins (Gubiani et al. 2006), and only 4 species in the rio Iguaçu basin (Baumgartner et al. 2012).

It is common among ichthyologists and taxonomists to find some level of difficulty in the identification of species of *Hypostomus* (Gosline 1947, Reis et al. 1990, Jerep et al. 2007), and this has generated several misidentifications in the literature. A possible explanation is that species of this genus exhibit high intraspecific variability, highly similar body shapes, and variable colour patterns of brown, black and yellow, with spots of different shapes and sizes all over the body (Armbruster 2004). Furthermore, *Hypostomus* is the largest genus of the Hypostominae and the second largest of order Siluriformes. In general, this group has a wide distribution, almost the same distribution as the entire family (Loricariidae). Species of *Hypostomus* can be found from the rio La Plata in Argentina to southern Costa Rica (Ferraris et al. 2003, Armbruster 2004). The representativeness of *H. ancistroides* shown in rio Ivaí basin (Fig. 2) is a constant in the La Plata system and also in streams of all upper rio Paraná basin (Oliveira et al. 2009, Gubiane et al. 2010, Araújo et al. 2011). Many species of *Hypostomus* were described based on a single specimen, which was often lost or poorly preserved, losing essential diagnostic features that are absent in the original descriptions, like those related to color pattern. In other cases, despite existence of the type material, species may have uncertain locality, which makes the collection of topotypes difficult. The original descriptions of the majority of species are too simple and often without figures.

The presence of endemic *Hypostomus* species in the rio Ivaí basin and several records of unidentified species, in addition to the abundance of poorly determined species, reveals that taxonomic revision of the genus and redescription of many species is needed, with designation of lectotypes when necessary. There are, in this river basin, common species still undescribed or with unresolved taxonomic status, which reveals that knowledge of the fish community from one of the largest tributaries of the upper rio Paraná basin is still lacking. More scientific research and environmental protection in headwater streams of this basin is needed.

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Authors' Contributions

ACD collected the data; CHZ identified the species; both authors wrote the text.

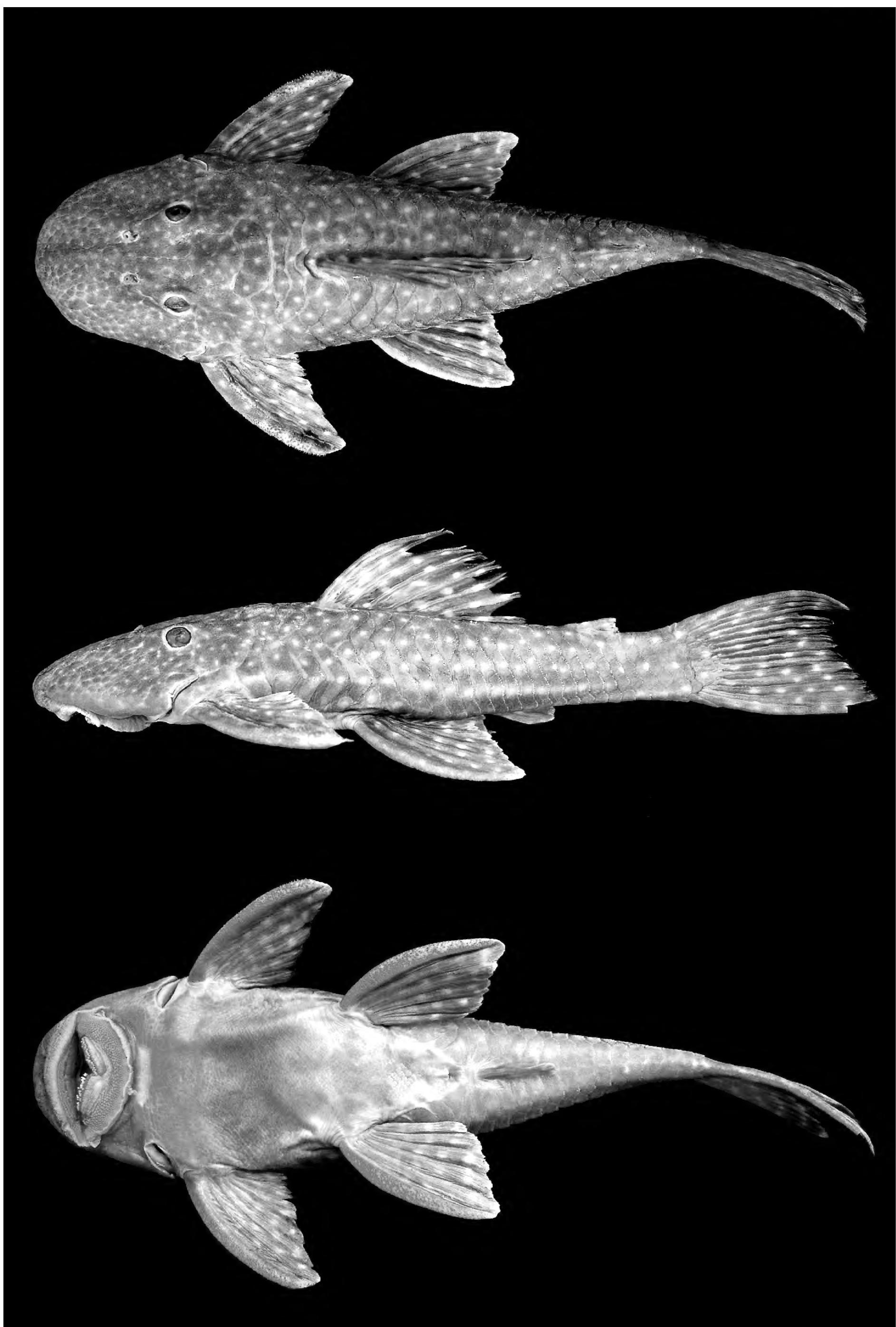


Figure 3. *Hypostomus albopunctatus*, NUP 2855, 165.1 mm SL, Brazil, Paraná state, municipality of Campo Mourão, rio Mourão, tributary of the rio Ivaí. Dorsal, lateral and ventral view.



Figure 4. *Hypostomus ancistroides*, NUP 848, 202.9 mm SL, Brazil, Paraná state, municipality of Prudentópolis, rio Patos, tributary of the rio Ivaí. Dorsal, lateral and ventral view.

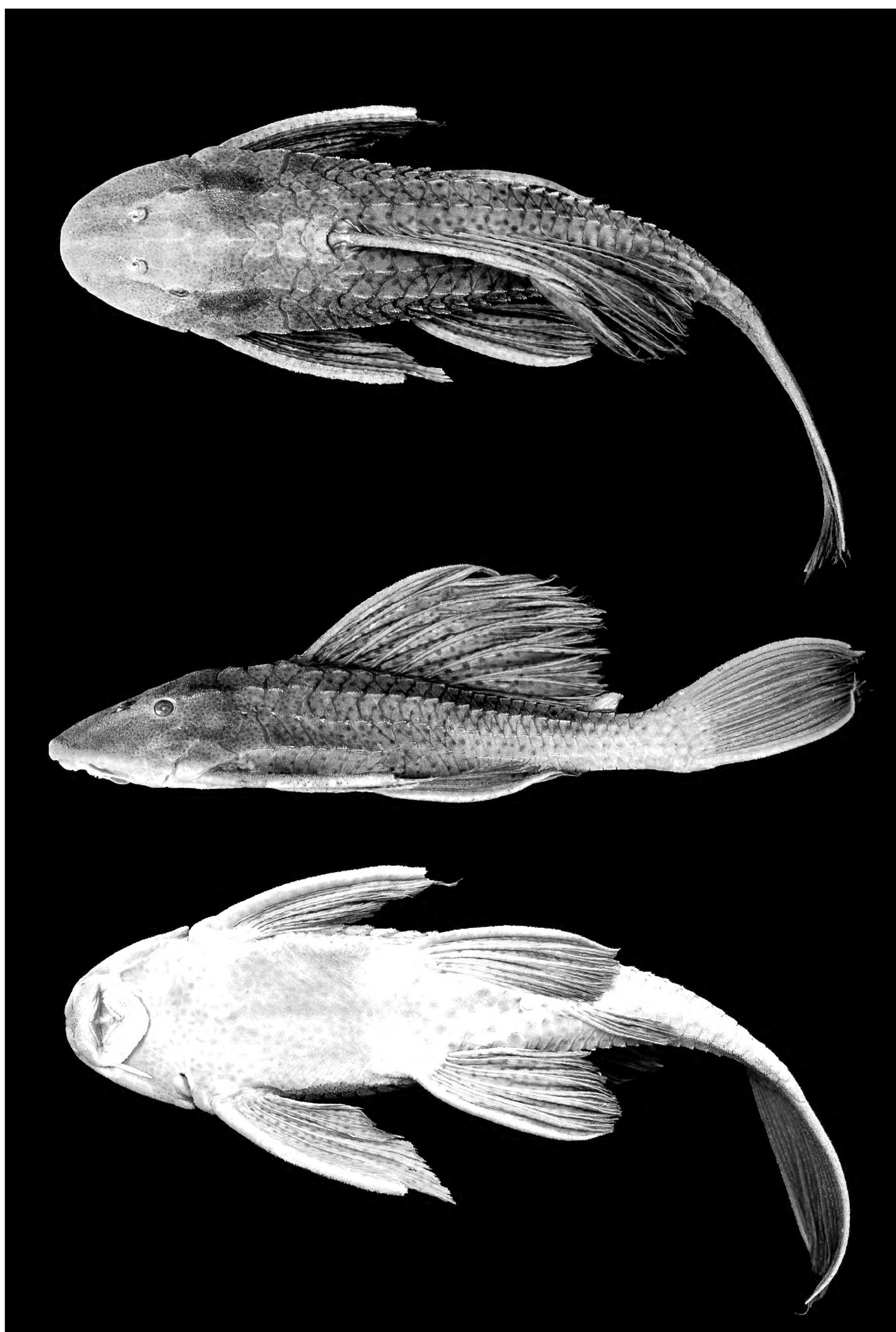


Figure 5. *Hypostomus commersoni*, NUP 856, 242.6 mm SL, Brazil, Paraná state, municipality of Campo Mourão, rio Mourão, tributary of the rio Ivaí. Dorsal, lateral and ventral view.

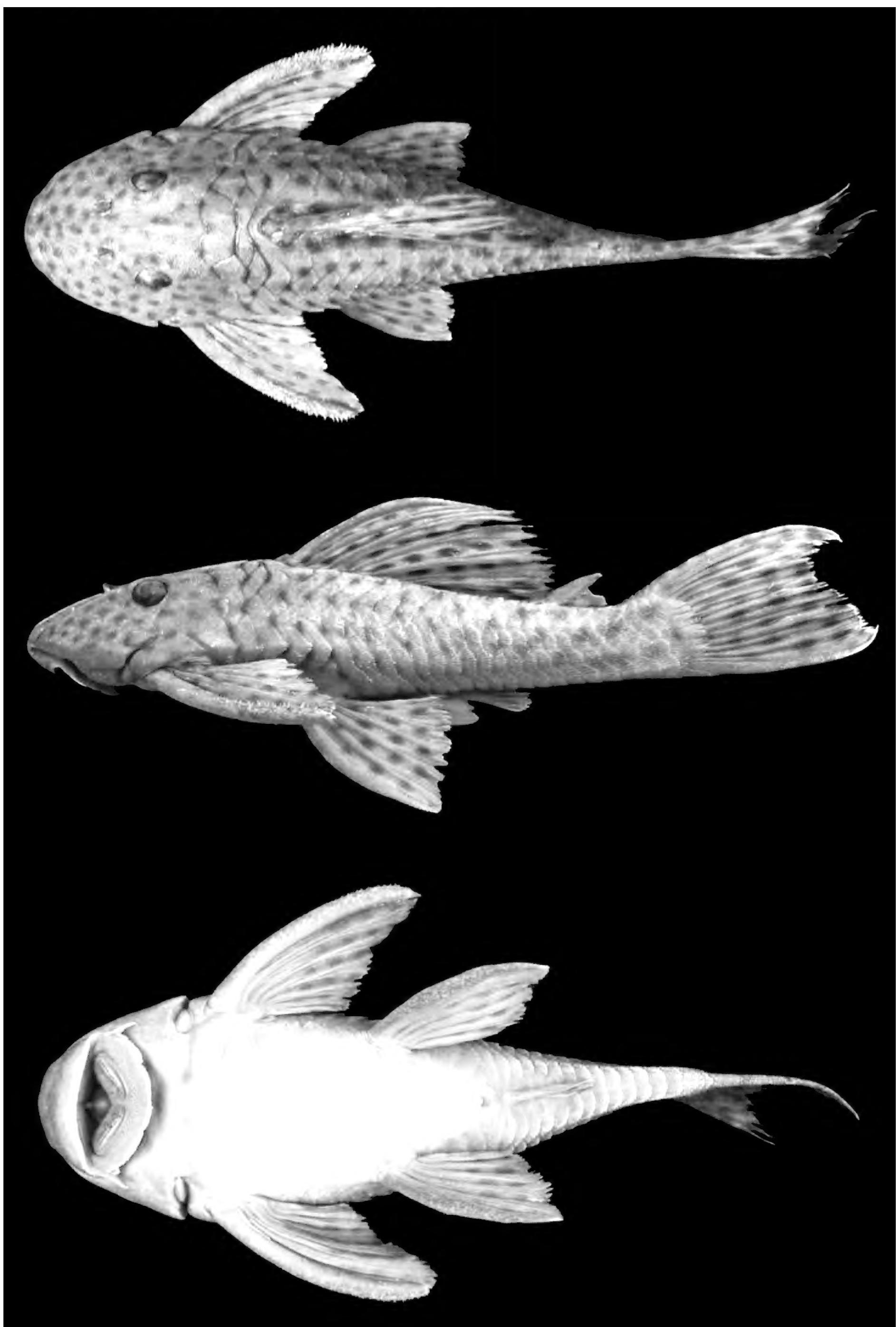


Figure 6. *Hypostomus hermanni*, NUP 5402, 175.1 mm SL, Brazil, Paraná state, municipality of Floresta, rio Ivaí. Dorsal, lateral and ventral view.

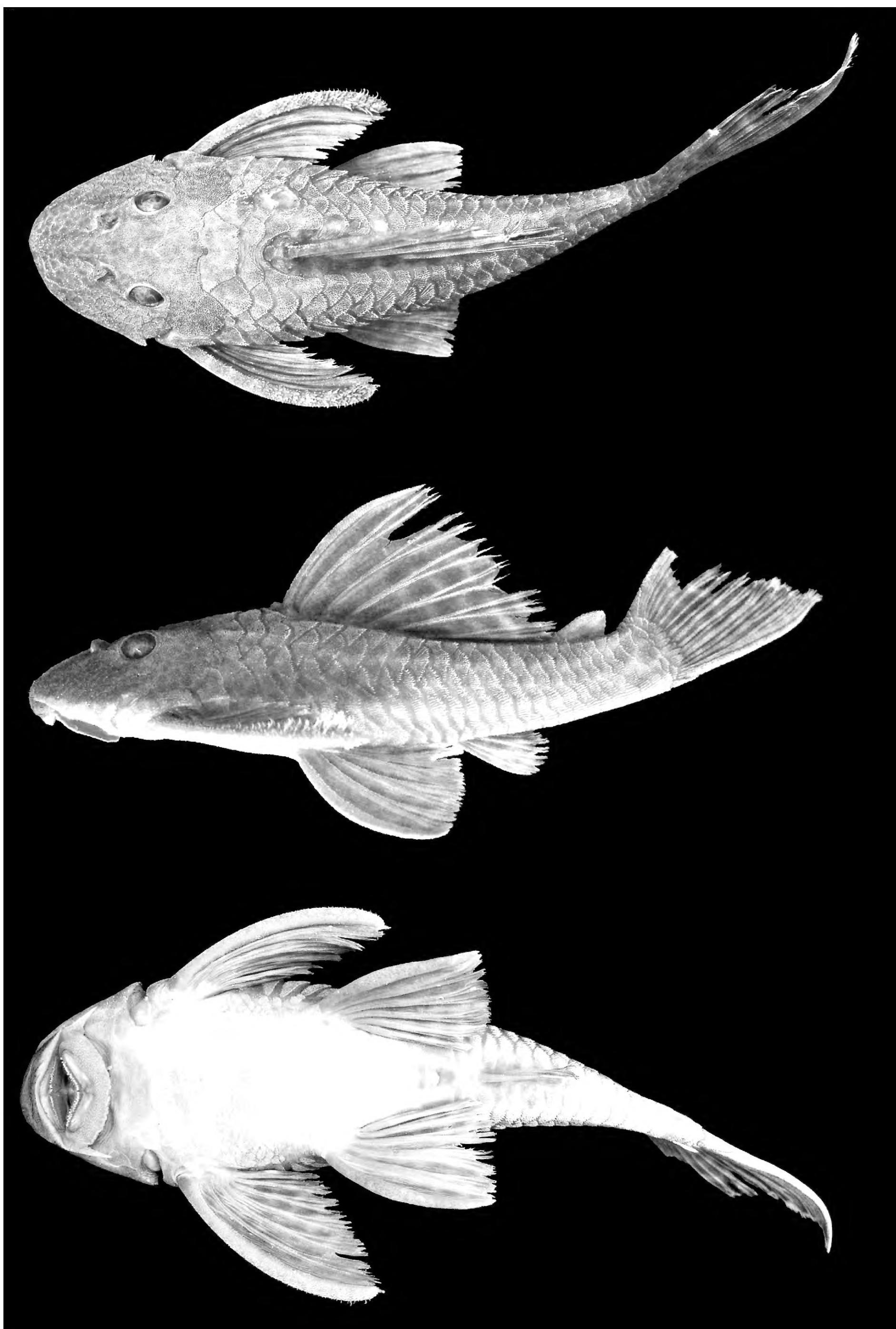


Figure 7. *Hypostomus iheringii*, NUP 4837, 139.8 mm SL, Brazil, Paraná state, municipality of Floresta, rio Ivaí. Dorsal, lateral and ventral view.

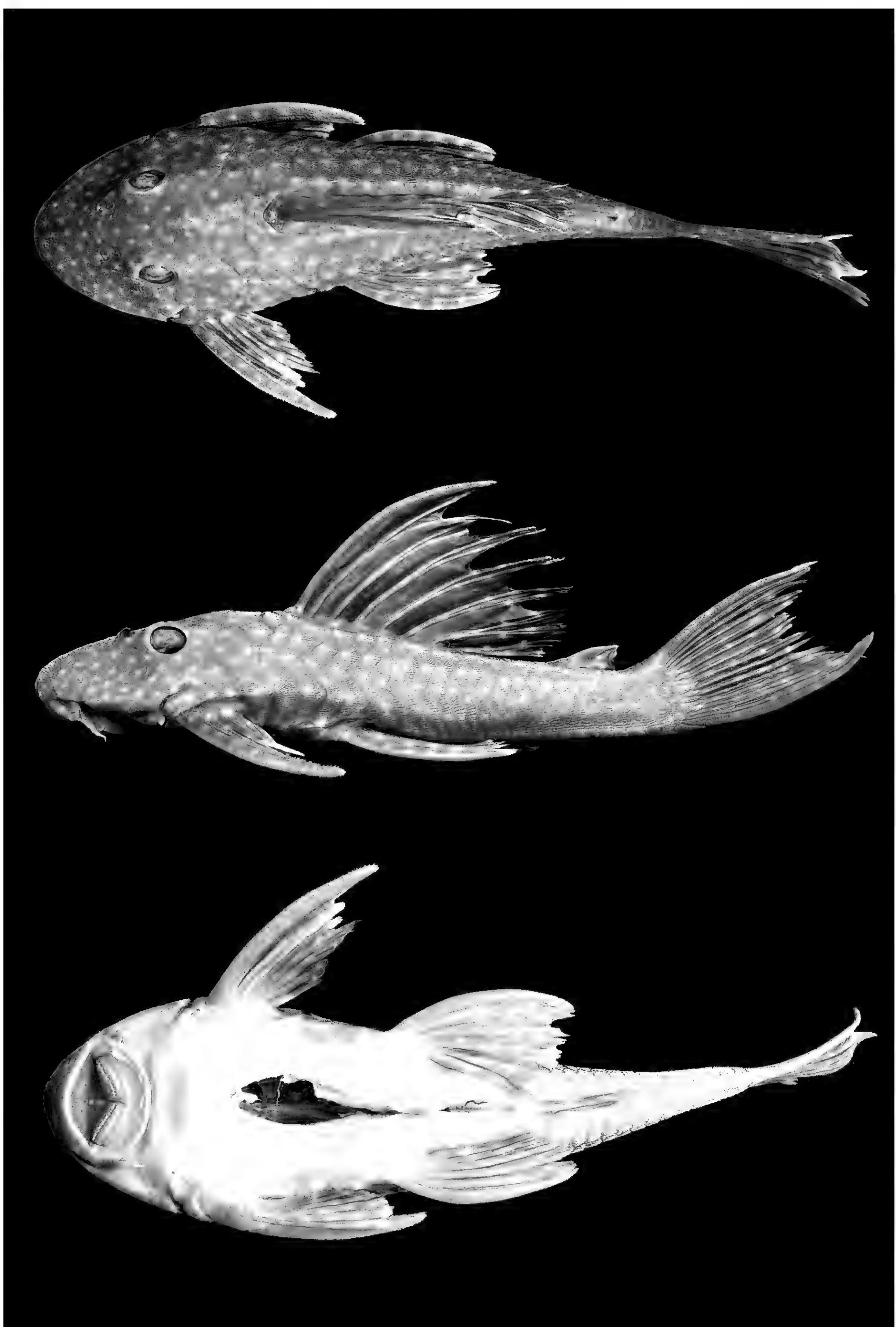


Figure 8. *Hypostomus margaritifer*, NUP 16477, 138.5 mm SL, Brazil, Paraná state, municipality of Floresta, rio Ivaí. Dorsal, lateral and ventral view.

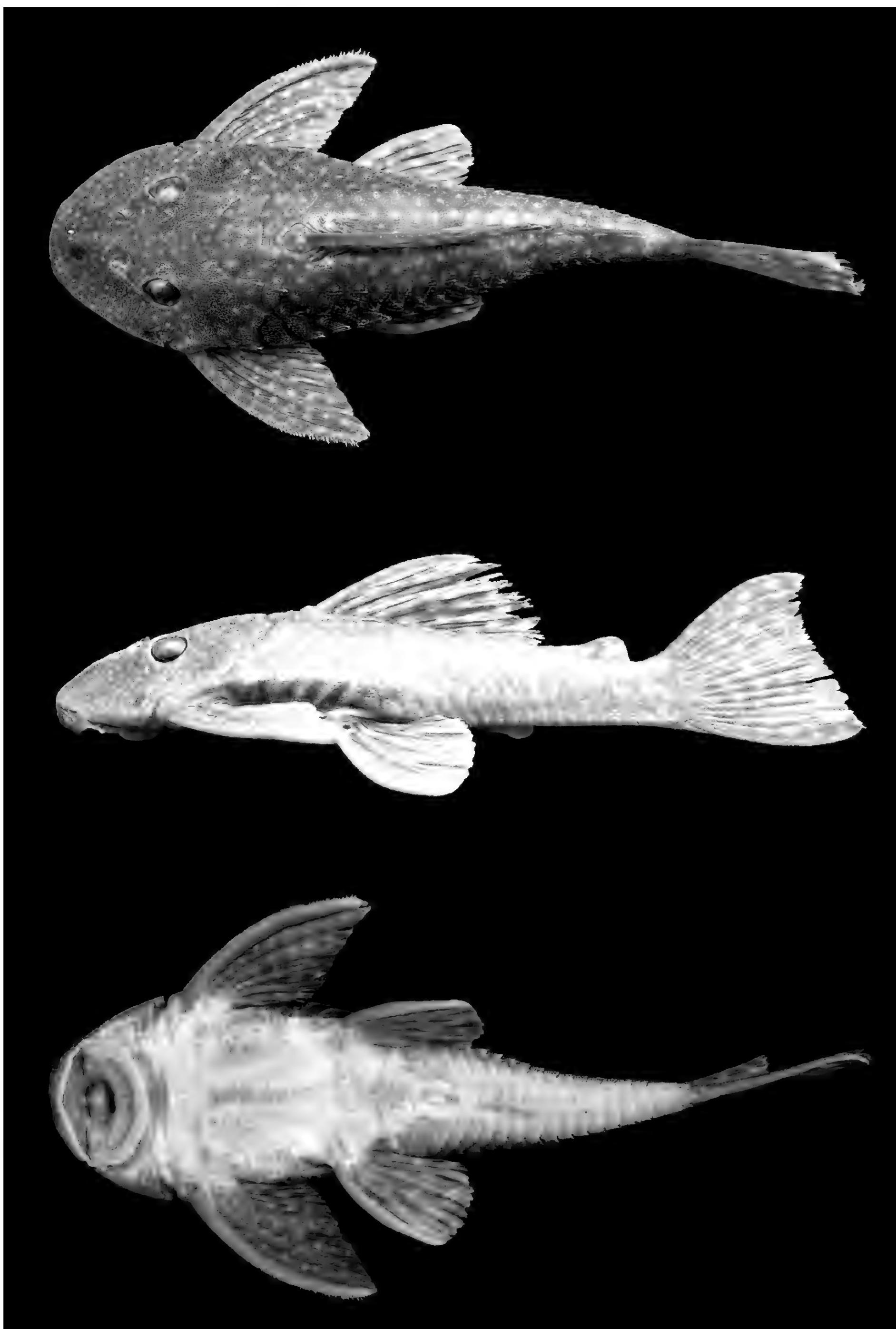


Figure 9. *Hypostomus* aff. *paulinus*, NUP 15329, 112.8 mm SL, Brazil, Paraná state, municipality of Campo Mourão, rio Mourão, tributary of the rio Ivaí. Dorsal, lateral and ventral view.

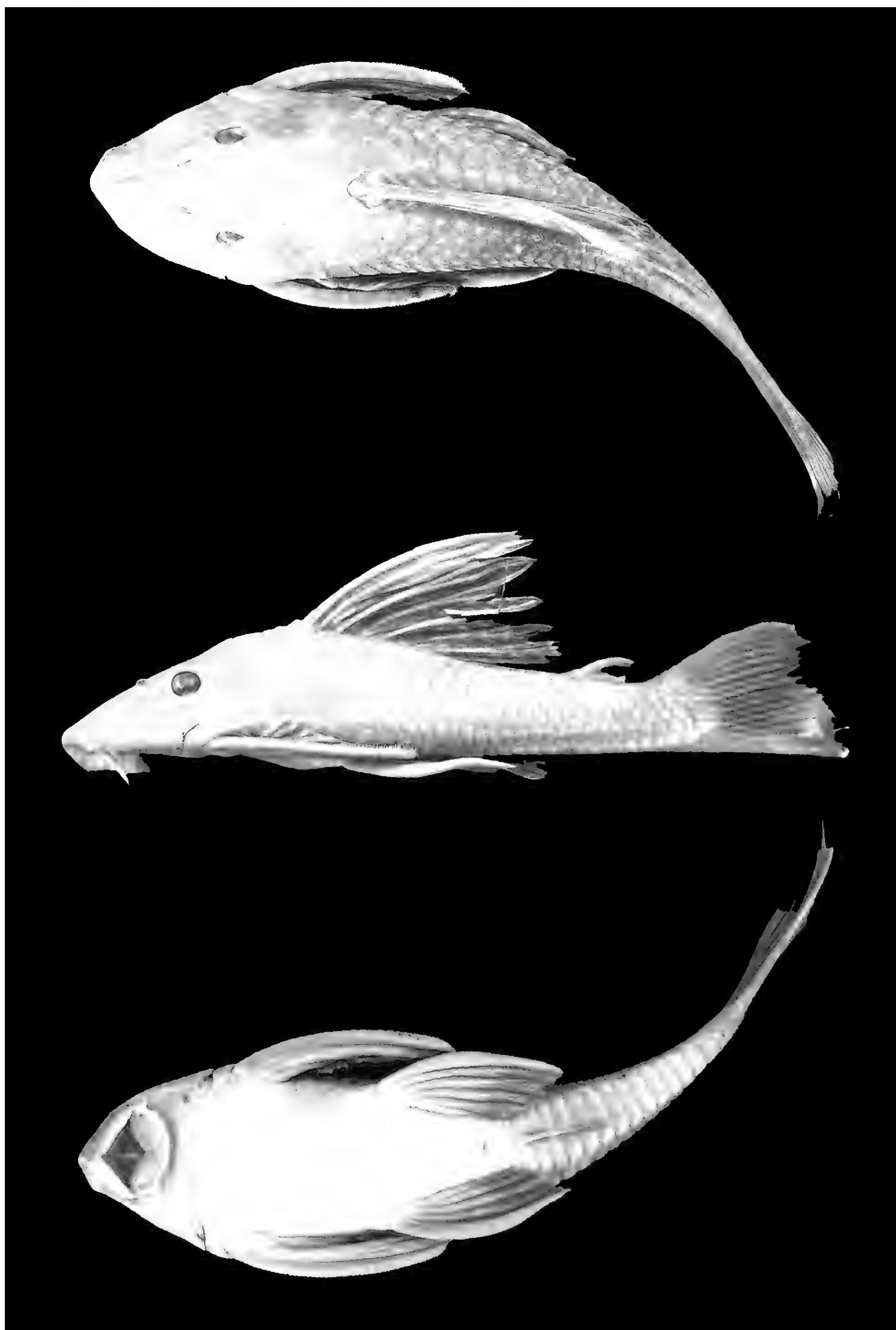


Figure 10. *Hypostomus regani*, NUP 4979, 234.9 mm SL. Brazil, Paraná state, municipality of Ivatuba, rio Ivaí. Dorsal, lateral and ventral view.

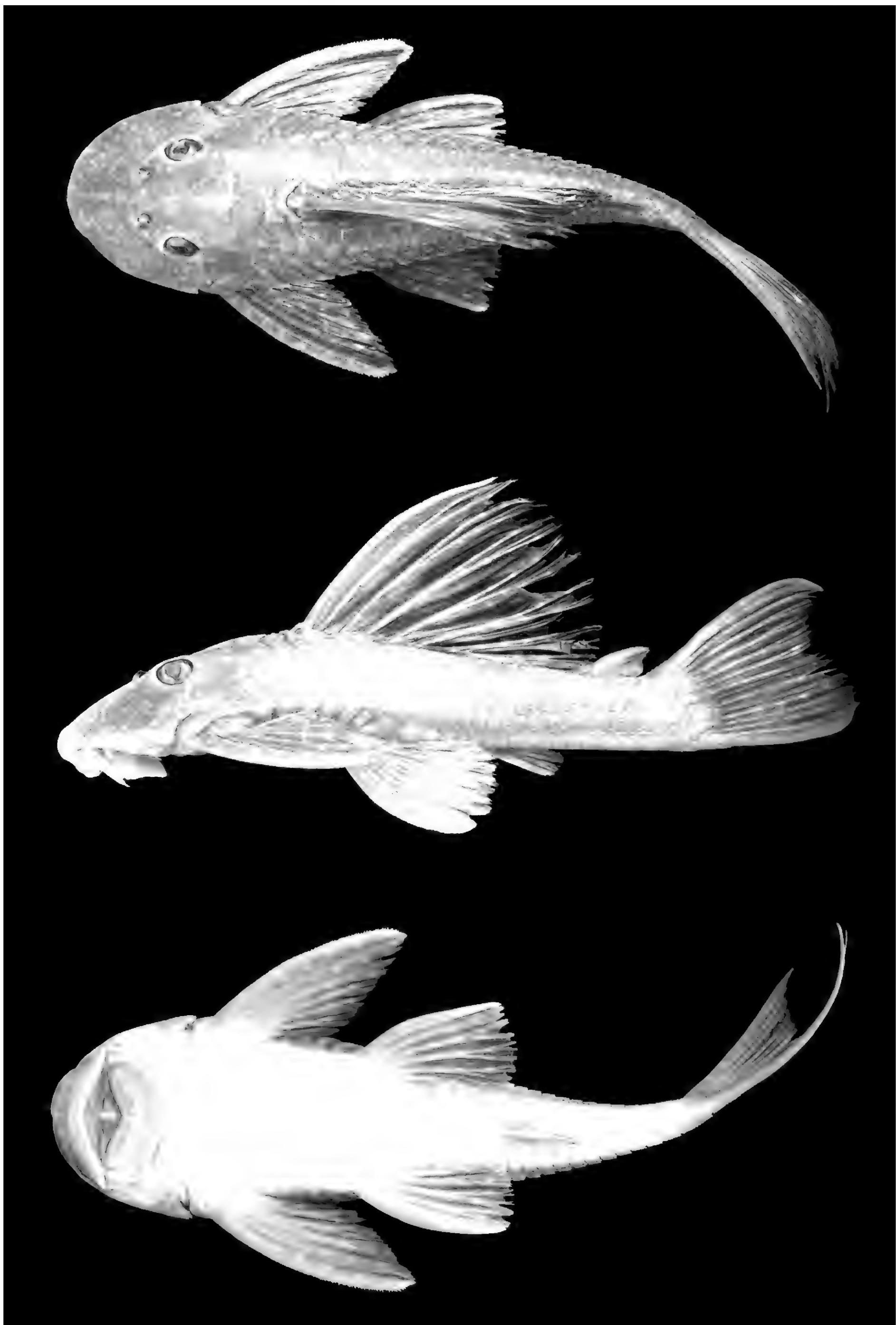


Figure 11. *Hypostomus strigaticeps*, NUP 19618, 129.6 mm SL, Brazil, Paraná state, municipality of Marialva, rio Keller, tributary of the rio Ivaí. Dorsal, lateral and ventral view.

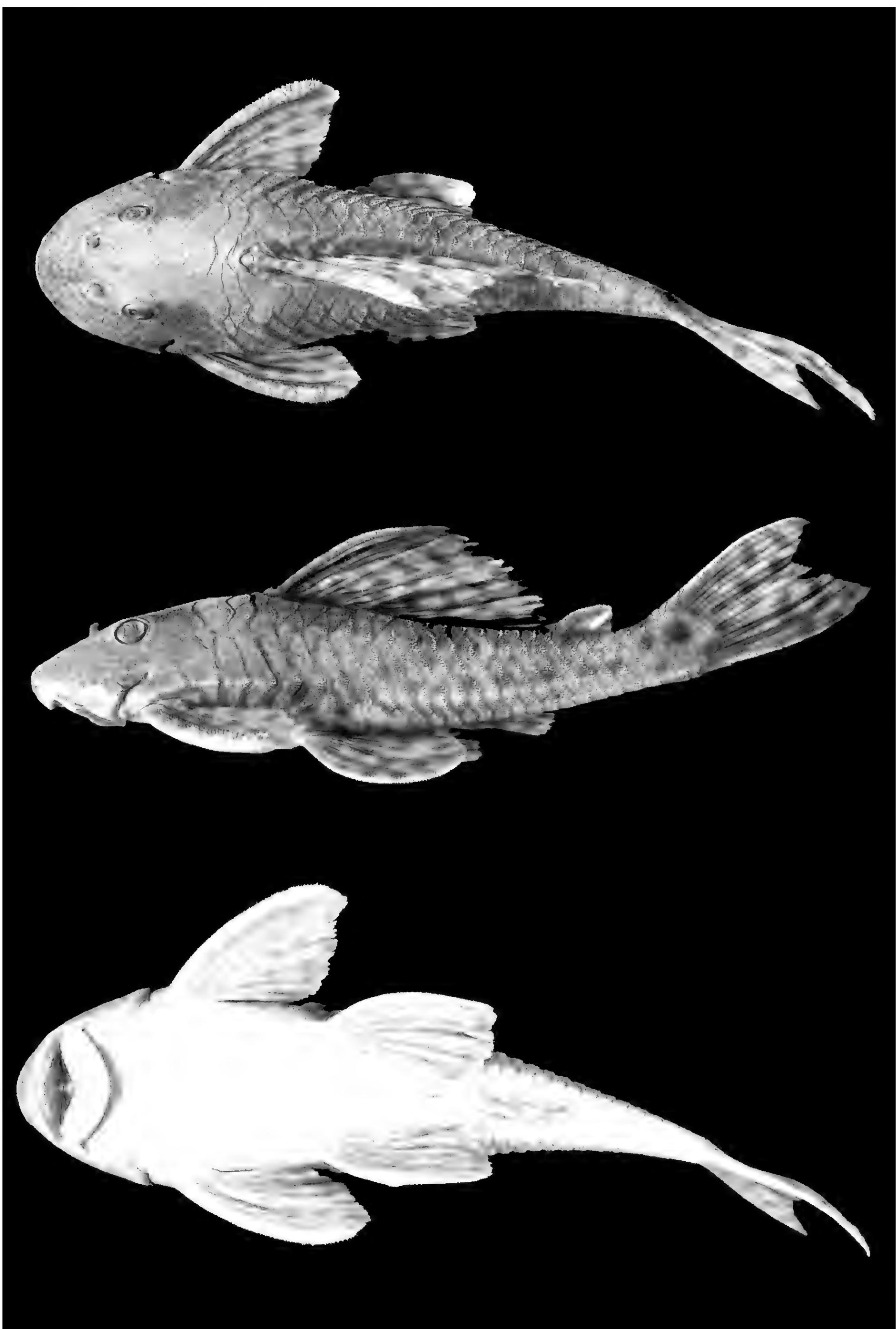


Figure 12. *Hypostomus topavae*, NUP 3745, 122.3 mm SL, Brazil, Paraná state, municipality of Marialva, rio Keller, tributary of the rio Ivaí. Dorsal, lateral and ventral view.



Figure 13. *Hypostomus* sp. 1, NUP 2597, 135.7 mm SL, Brazil, Paraná state, municipality of Marialva, rio Keller, tributary of the rio Ivaí. Dorsal, lateral and ventral view.

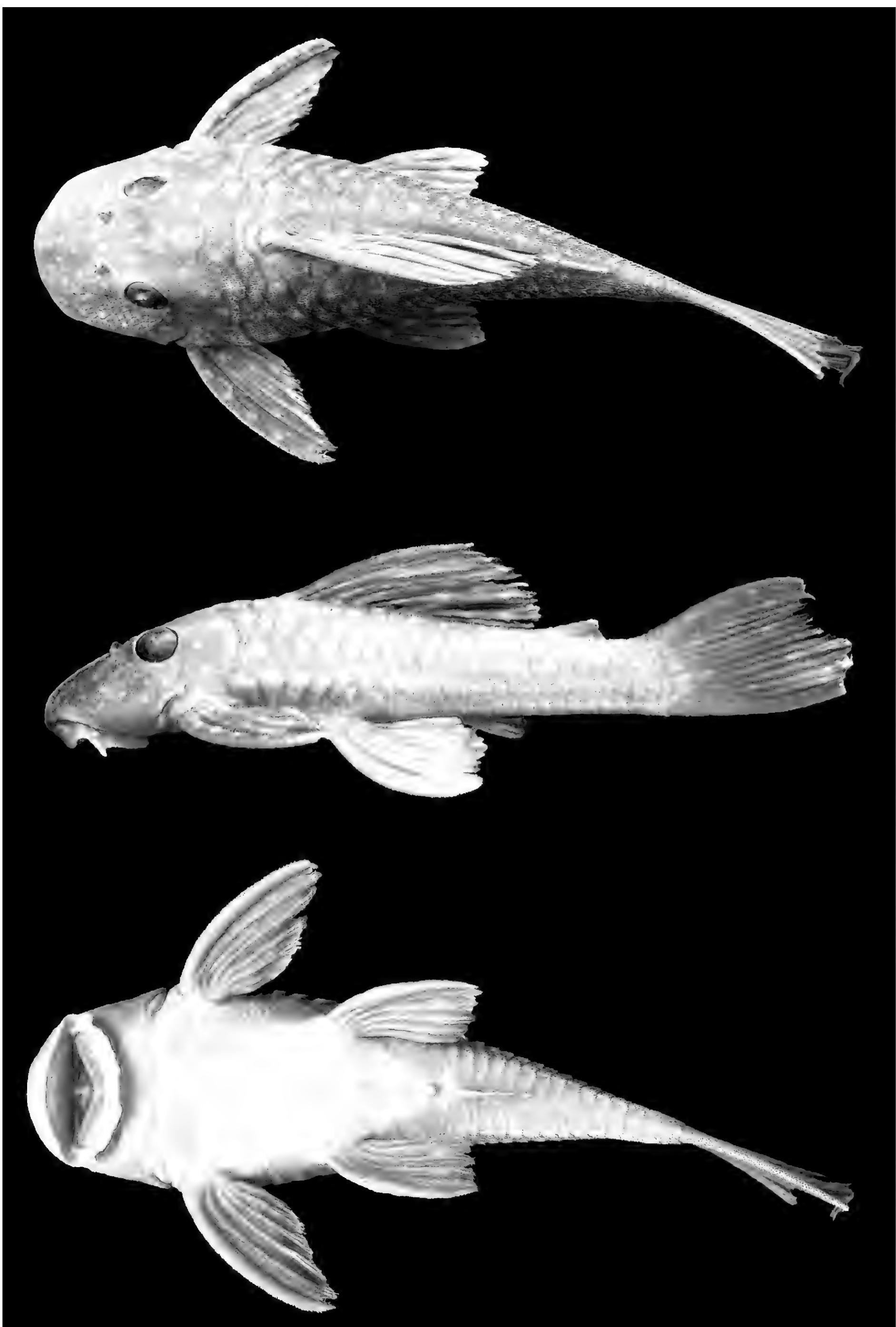


Figure 14. *Hypostomus* sp. 2, NUP 3030, 116.2 mm SL, Brazil, Paraná state, municipality of Campo Mourão, rio Mourão, tributary of the rio Ivaí. Dorsal, lateral and ventral view.

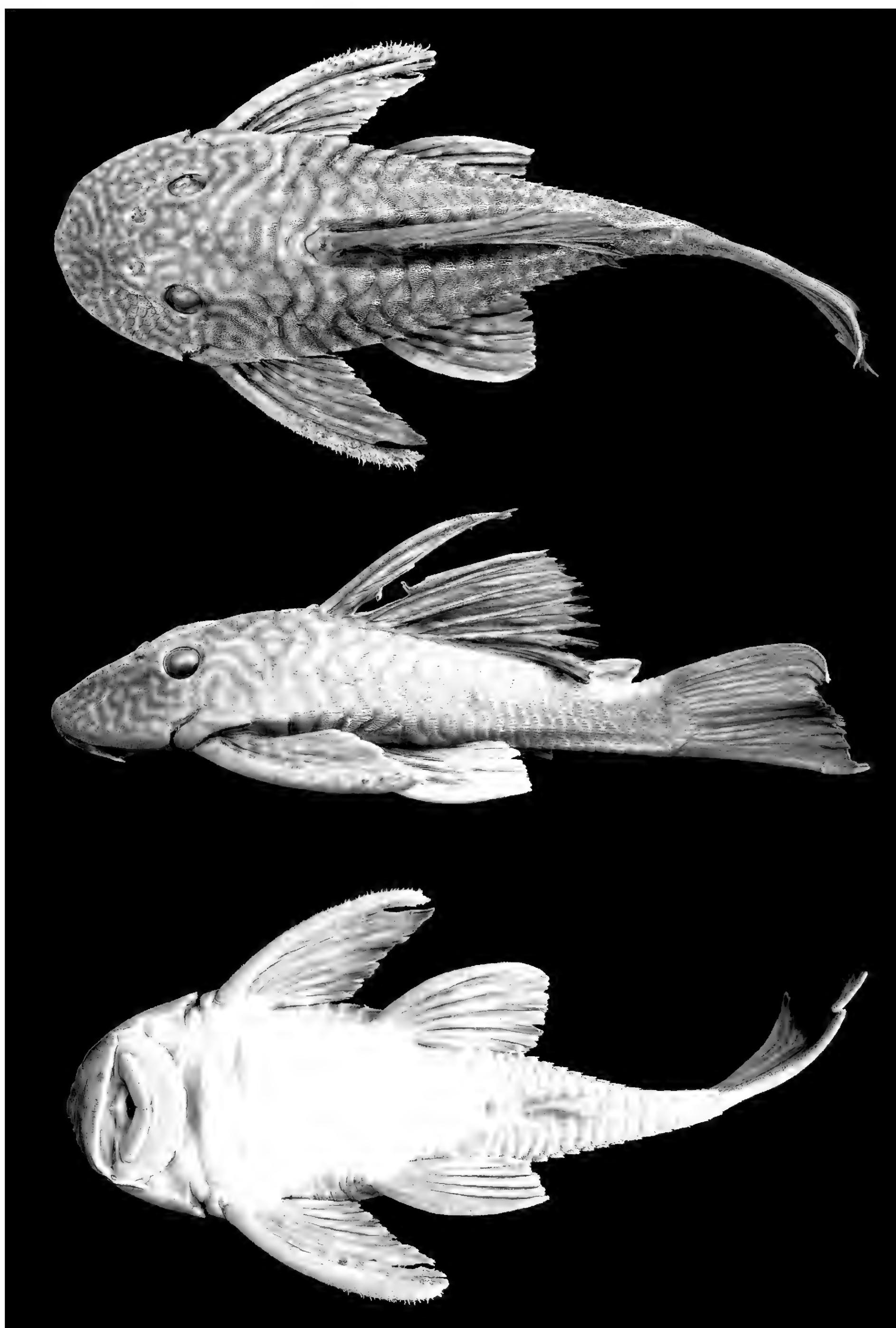


Figure 15. *Hypostomus* sp. 3, NUP 10917, 142.3 mm SL, Brazil, Paraná state, municipality of Ivatuba, rio Ivaí. Dorsal, lateral and ventral view.

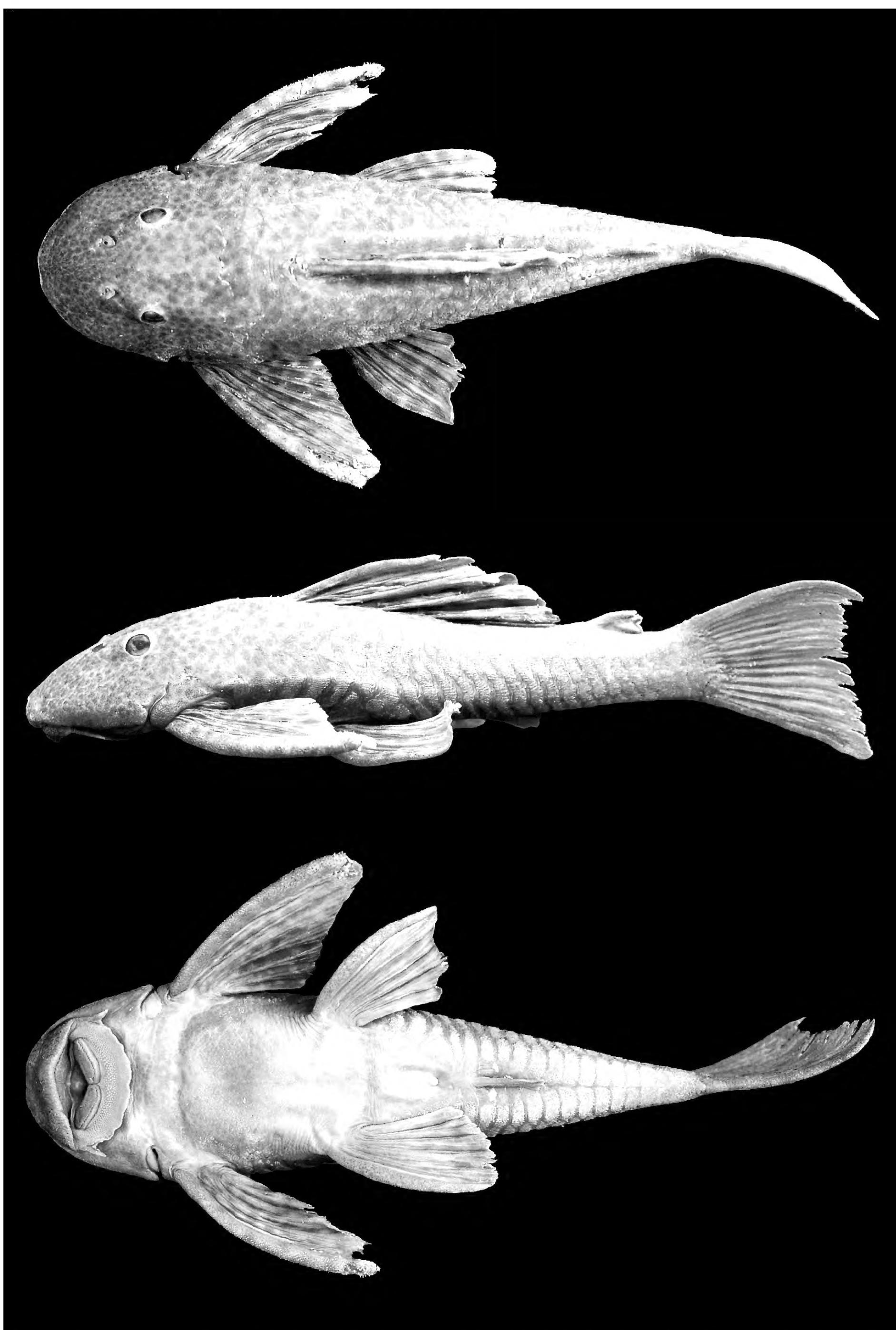


Figure 16. *Hypostomus* sp. 4, NUP 4745, 149.1 mm SL, Brazil, Paraná state, municipality of Nova Tebas, rio Muquilão, tributary of the rio Ivaí. Dorsal, lateral and ventral view.

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Appendix

Voucher specimens deposited in ichthyological collections.

Materials examined. 586 specimens, Brazil, Paraná state, rio Ivaí basin.

***Hypostomus albopunctatus*.** NUP 2826, 6, 51.0–99.0 mm SL, rio Mourão, 24°02'23" S, 052°16'22" W. NUP 2852, 4, 61.3–73.0 mm SL, rio Mourão, 24°02'23" S, 052°16'22" W. NUP 3026, 5, 51.0–119.3 mm SL, rio Mourão, 24°02'23" S, 052°16'22" W. NUP 4311, 12, 48.9–161.8 mm SL, tributary of rio Campo, 23°59'03" S, 052°21'25" W. NUP 5969, 2, 113.4–170.8 mm SL, rio Mourão, 23°59'03" S, 052°21'25" W. NUP 6440, 2, 71.7–99.0 mm SL, rio Mourão, 24°00'00" S, 052°19'34" W. NUP 7072, 1, 80.0 mm SL, rio Andirá, 23°22'02" S, 052°11'42" W. NUP 10109, 5, 55.9–87.3 mm SL, rio Mourão, 24°14'21" S, 052°19'57" W. NUP 10551, 1, 160.4 mm SL, rio Mourão, 24°02'23" S, 052°16'22" W. NUP 10852, 1, 98.5 mm SL, unknown river.

***Hypostomus ancistroides*.** NUP 848, 13, 129.6–231.6 mm SL, reservoir rio dos Patos, 25°12'47" S, 050°58'40" W. NUP 849, 11, 146.3–200.0 mm SL, reservoir rio dos Patos, 25°12'47" S, 050°58'40" W. NUP 850, 7, 170.0–212.0 mm SL, reservoir rio dos Patos, 25°12'47" S, 050°58'40" W. NUP 851, 5, 142.4–172.3 mm SL, reservoir rio dos Patos, 25°12'47" S, 050°58'40" W. NUP 855, 4, 165.1–221.9 mm SL, rio Mourão, 24°07'26.58" S, 052°19'17.89" W. NUP 2859, 7, 62.4–223.8 mm SL, rio Mourão, 24°02'23" S, 052°16'22" W. NUP 3024, 1, 173.7 mm SL, rio Mourão, 24°02'23" S, 052°16'22" W. NUP 3743, 3, 88.6–134.4 mm SL, rio Keller, 23°38'05" S, 051°50'50" W. NUP 4329, 5, 80.6–182.3 mm SL, rio São João. NUP 4467, 2, 167.5–175.9 mm SL, rio Tatu-Peba, 23°29'59" S, 052°01'04" W. NUP 4862, 7, 169.3–191.6 mm SL, rio Tormentinho. NUP 5322, 10, 160.3–208.4 mm SL, rio Moscado, 23°25'38" S, 051°55'57" W. NUP 5382, 11, 40.5–210.5 mm SL, rio Arroio Guaçu. NUP 5546, 26, 46.5–180.1 mm SL, rio Barra Bonita, 25°02'S, 051°04' W. NUP 14325, 1, 183.7 mm SL, rio 19, 23°18'44" S, 052°35'38" W. NUP 14971, 1, 161.0 mm SL,

rio Pitanga, 24°41'37" S, 051°31'03" W. NUP 15165, 13, 94.1–150.2 mm SL, rio Keller, 23°30'S, 052°00' W. NUP 16380, 4, 33.3–159.4 mm SL, rio Lajeado, 24°32'26.93" S, 051°20'09.80" W. NUP 16440, 7, 130.8–207.0 mm SL, rio dos Patos, 25°11'14.07" S, 050°57'04.8" W.

***Hypostomus commersoni*.** CIG 2054, 3, 108.3–207.9 mm SL, rio Ivaí. NUP 856, 8, 118.6–242.5 mm SL, rio Mourão, 24°07'26.58" S, 052°19'17.89" W.

***Hypostomus hermanni*.** NUP 3641, 2, 84.1–85.7 mm SL, rio Água Fria, 24°31'14" S, 051°40'12" W. NUP 5402, 9, 113.2–181.4 mm SL, rio Ivaí, 23°42' S, 052°07' W. NUP 5403, 10, 87.4–173.3 mm SL, rio Ivaí, 23°42'S, 052°07' W. NUP 6409, 21, 104.6–206.3 mm SL, rio Ivaí, 23°40'32.64" S, 052°07'13.65" W. NUP 9806, 1, 184.3 mm SL, rio Ivaí, 23°38'30" S, 052°15'41" W.

***Hypostomus iheringii*.** NUP 4837, 3, 118.5–139.8 mm SL, rio Ivaí, 23°40'32.64" S, 052°07'13.65" W.

***Hypostomus margaritifer*.** NUP 4921, 1, 162.3 mm SL, rio Ivaí, 23°42'S 52°07' W. NUP 16477, 1, 138.5 mm SL, rio Ivaí, 23°40'32.64" S, 052°07'13.65" W.

***Hypostomus cf. paulinus*.** NUP 2828, 7, 81.5–129.1 mm SL, rio Mourão, 24°02'23" S, 052°16'22" W. NUP 7061, 1, 105.4 mm SL, rio Mourão, 24°02'23" S 52°16'22" W. NUP 9732, 1, 149.6 mm SL, rio Ivaí, 23°40'32.64" S, 052°07'13.65" W. NUP 15329, 1, 112.8 mm SL, rio Mourão, 24°00'00" S, 052°19'34" W.

***Hypostomus regani*.** NUP 4360, 5, 255.0–285.0 mm SL, rio Ivaí, 23°42'S, 052°07' W. NUP 4979, 2, 232.7–245.9 mm SL, rio Ivaí, 23°42'S, 052°07' W. NUP 5015, 2, 81.5–129.1 mm SL, rio Mourão, 24°02'21" S, 052°16'22" W.

***Hypostomus strigaticeps*.** NUP 4530, 2, 89.7–96.3 mm SL, rio Muquilão, 24°24'33" S, 052°02'39" W. NUP 7512, 6, 187–214 mm SL, rio Ivaí, 23°42'S, 052°07' W. NUP 19618, 1, 129.6 mm SL, rio Keller, 23°30'S, 052°00' W.

***Hypostomus topavae*.** NUP 2596, 13, 79.9–108.2 mm SL, rio Keller, 23°30'S, 052°00' W. NUP 4458, 4, 65.9–102.9 mm SL, rio Ivaí, 23°42'S, 052°07' W. NUP 4460, 5, 62.6–108.8 mm SL, rio Piavas, 23°54'S, 054°17' W. NUP 4529, 12, 49.9–116.4 mm SL, rio Muquilão, 24°24'33" S, 052°02'39" W. NUP 4742, 1, 136.0 mm SL, rio Muquilão, 24°24'33" S, 052°02'39" W. NUP 9630, 11, 29.1–118.5 mm SL, rio Xapéco, 23°25'32" S, 052°10'02" W. NUP 13644, 3, 34.8–76.3 mm SL, rio Jacutinga, 23°21'06" S, 052°27'58" W.

Hypostomus sp. 1. NUP 2597, 32, 58.4–138.5 mm SL, rio Keller. NUP 3641, 2, 84.1–85.7 mm SL, rio Água Fria. NUP 3744, 37, 58.7–119.4 mm SL, rio Keller. NUP 17253, 5, 88.9–108.9 mm SL, rio Keller. NUP 17255, 2, 76.2–111.9 mm SL, rio Keller.

Hypostomus sp. 2. NUP 2594, 20, 62.0–89.5 mm SL, rio Keller. NUP 3030, 3, 48.9–116.2 mm SL, rio Mourão. NUP 3031, 28, 70.51–89.75 mm SL, rio Mourão. NUP 4842, 27, 89.8–122.0 mm SL, rio Ivaí. NUP 5528, 1, 140.6 mm SL, rio Barra Bonita. NUP 7962, 1, 89.4 mm SL, rio Mourão. NUP 11722, 1, 123.7 mm SL, rio Keller.

Hypostomus sp. 3. NUP 2594, 20, 62.0–89.5 mm

SL, rio Keller. NUP 3742, 2, 132.6–143.4 mm SL, rio Keller. NUP 3746, 14, 63.9–98.8 mm SL, rio Keller. NUP 5612, 10, 109.5–143.6 mm SL, rio Ivaí. NUP 5613, 17, 68.4–122.1 mm SL, rio Ivaí. NUP 10917, 6, 130.9–141.4 mm SL, rio Ivaí. NUP 10952, 14, 96.3–127.3 mm SL, rio Keller. NUP 15536, 2, 89.3–152.1 mm SL, rio dos Patos. NUP 15651, 4, 98.5–124.8 mm SL, rio Mourão.

***Hypostomus* sp. 4.** NUP 4457, 1, 93.1 mm SL, rio das Piavas. NUP 4743, 1, 179.3 mm SL, rio Muquilão. NUP 4745, 17, 38.8–170.9 mm SL, rio Muquilão. NUP 8535, 1, 172.5 mm SL, rio Pedrinho. NUP 8536, 3, 139.3–156.9 mm SL, rio Bonito. NUP 10635, 1, 129.0 mm SL, rio Bonito. NUP 10852, 1, 98.5 mm SL, unnamed river. NUP 11206, 1, 127.7 mm SL, rio Bonito.